

IOWA STATE UNIVERSITY

Digital Repository

Proceedings of the Integrated Crop Management
Conference

Proceedings of the 24th Annual Integrated Crop
Management Conference

Nov 28th, 12:00 AM

Economics of corn stover

William Edwards

Iowa State University, wedwards@iastate.edu

Chad Hart

Iowa State University, chart@iastate.edu

Kelvin Leibold

Iowa State University, kleibold@iastate.edu

Follow this and additional works at: <https://lib.dr.iastate.edu/icm>



Part of the [Agricultural and Resource Economics Commons](#), [Agricultural Economics Commons](#),
and the [Industrial Organization Commons](#)

Edwards, William; Hart, Chad; and Leibold, Kelvin, "Economics of corn stover" (2012). *Proceedings of the Integrated Crop Management Conference*. 10.

<https://lib.dr.iastate.edu/icm/2012/proceedings/10>

This Event is brought to you for free and open access by the Conferences and Symposia at Iowa State University Digital Repository. It has been accepted for inclusion in Proceedings of the Integrated Crop Management Conference by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

Economics of corn stover

William Edwards, professor and Extension economist, Economics, Iowa State University;
Chad Hart, associate professor and Extension economicist, Economics, Iowa State University;
Kelvin Leibold, Extension farm management specialist, Iowa State University

The biomass market

In the midst of rising energy prices, Congress sought to incentivize the development of alternative fuel systems. One major component of that incentive was the passage of the 2007 Energy Act. The 2007 Energy Act established the current Renewable Fuels Standard (known as RFS2) and categorized renewable fuels into four basic areas: conventional biofuels, cellulosic biofuels, biodiesel, and additional advanced biofuels.

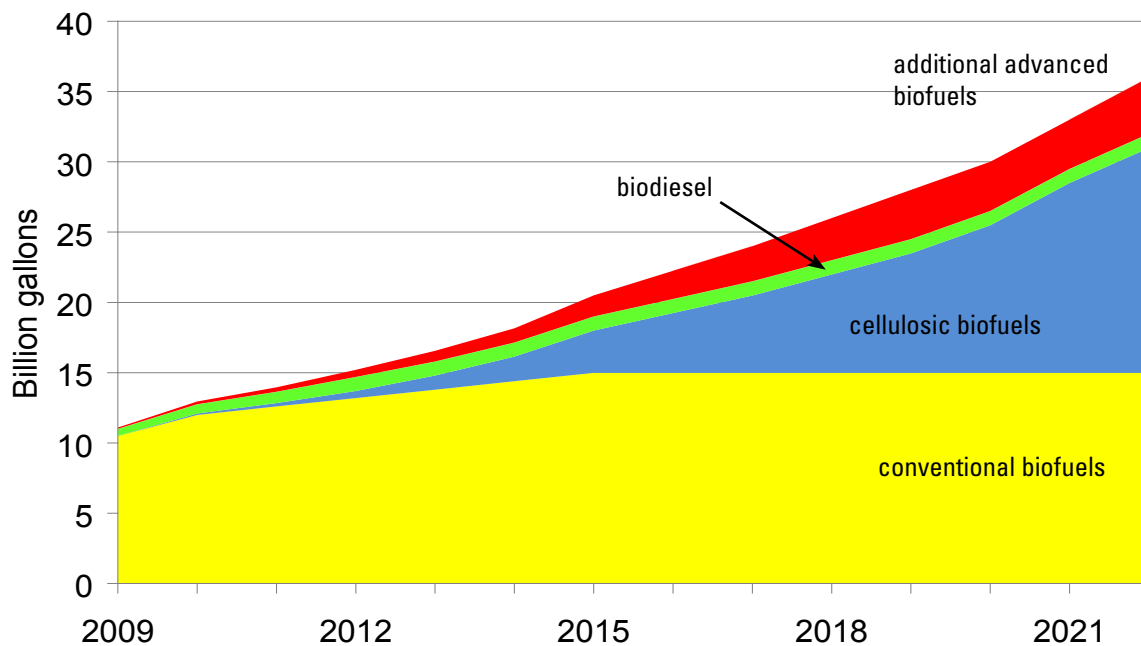


Figure 1. The Renewable Fuels Standard.

Three of these four areas had well established fuel systems. The conventional biofuel component is being filled by corn-grain-based ethanol. Biodiesel is being created using a number of feedstocks, including soybean oil. The additional advanced biofuel component is being filled by sugarcane-based ethanol. But the cellulosic biofuel component did not have a well-established fuel system. Both the U.S. Departments of Energy and Agriculture have examined the country's potential for biomass production and the resulting energy products that could possibly be created from biomass. As the following map shows, many areas of the country could produce sizable quantities of biomass.

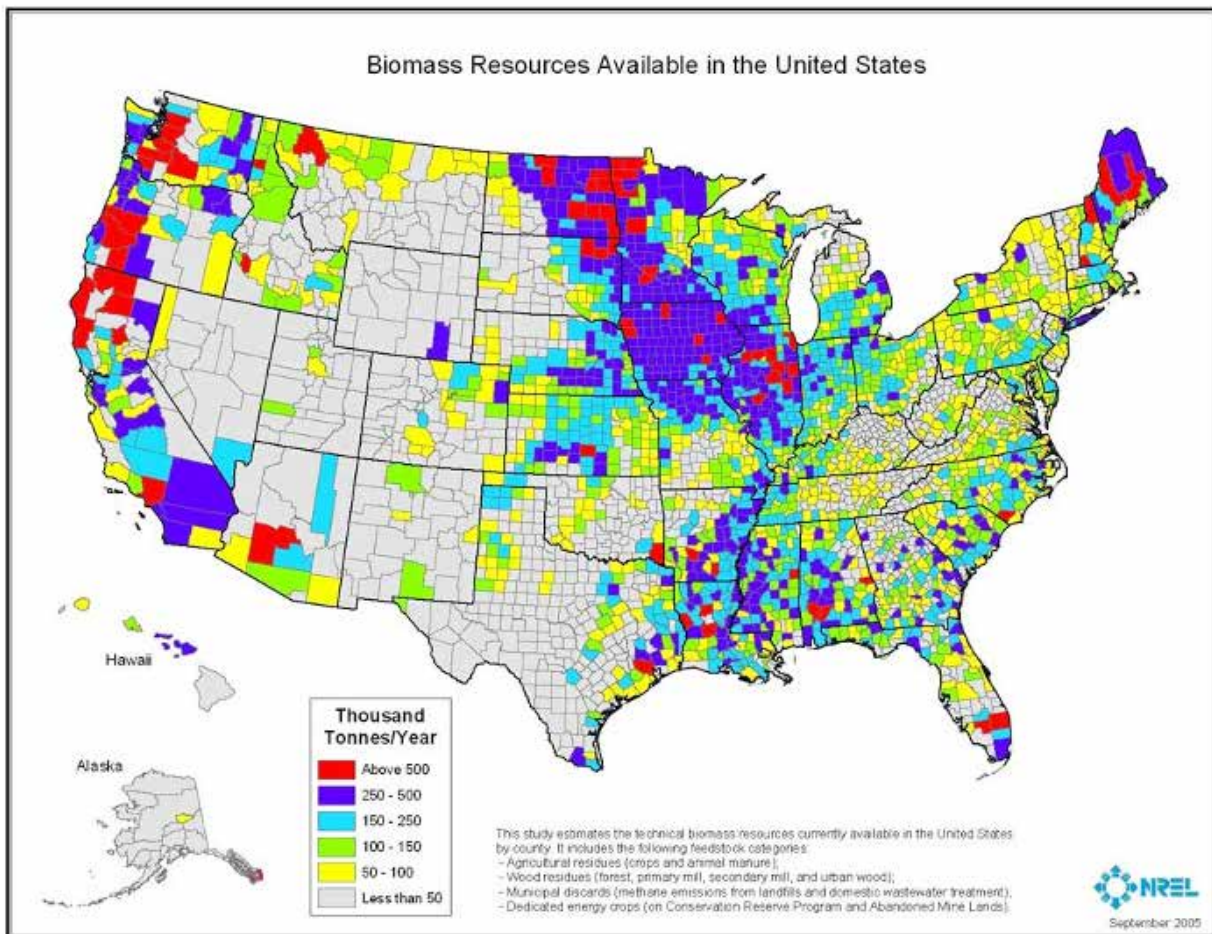


Figure 2. Biomass resources in the U.S. (Source: NREL, 2005).

These biomass resources range from forest thinnings in the Pacific Northwest to wheat straw in the Great Plains to rice straw in the Mississippi Delta. One of the largest sources of biomass is corn stover. Thus, corn stover is being targeted as the feedstock for the first two commercial-size cellulosic biofuel plants, the POET plant in Emmetsburg and the DuPont plant in Nevada.

As cellulosic biofuel would be a brand new market, there is a lot of uncertainty about many aspects of biomass production, pricing, and markets. Corn producers already create the stover as part of their normal business, producing corn; but questions remain about the potential revenues from stover and the costs of stover removal. Also, what are the potential revenues and costs from cellulosic biofuel production and how will these revenues/costs be distributed between crop producers and biofuel plants?

In a first step to address some of these questions, both POET and DuPont have contracted with corn producers to purchase corn stover. The contracts are legally binding agreements that outline the risk-return tradeoff between the biofuel plants and corn producers. And these contracts address many of the major benefits/challenges that corn producers have about the harvest and sale of corn stover.

Jarboe, et al. (2012) examined many of these issues in a survey of Iowa crop farmers. They found while many crop producers have moderate knowledge about corn-grain ethanol, their knowledge of cellulosic biofuels was limited. Crop producers showed more interest in providing corn stover for biofuel development than other types of biomass, including grasses, trees, and legumes. However, the producers also indicated they had concerns about soil erosion and nutrient loss due to corn stover harvesting.

Table 1 outlines the top 10 challenges crop producers face when exploring participation in the potential cellulosic biofuel market. The POET and DuPont contracts have been written to address some of these challenges and to highlight the potential benefits to producers of participating in the cellulosic biofuel supply chain.

Table 1. Producer challenges to corn stover marketing

Challenge	Average Rating ¹
Nutrient loss	5.55
Distance to markets	5.52
Long-term biomass market viability	5.44
Biomass price volatility	5.26
Soil erosion issues	5.19
Percent of biomass removed	5.13
In-field transport and compaction	5.00
Contract opt-out clauses	4.99
Contract terms of storage	4.93
Residue management	4.92

¹ A rating of 1 indicated “Not concerned,” while a rating of 7 indicated “Very concerned.”

Source: Jarboe, et al. (2012)

Valuing corn stover

The value of the stover can be derived in several ways. The minimum price is the cost of corn stover removal from the perspective of the seller (the corn producer). Those costs include the cost of harvesting the stover (unless the buyer does the harvesting) and the added fertilizer expense to make up for lost nutrients. The maximum price is the potential value of the stover to the buyer. For biofuels, this value is tied to the prices of crude oil, gasoline, and other biofuels (including corn-grain ethanol). For stover used as a supplemental livestock feed, the maximum price the livestock producer can pay is the value of the alternative feeds replaced. The negotiated price for the corn stover must be between the minimum and maximum values.

Feed value

Corn stover is an abundant source of winter feed for beef cows in Iowa. When supplemented with protein, vitamins, and minerals, stover can supply the nutritional needs of cows that are in moderately good body condition during fall and early winter. The obvious advantage of utilizing corn stover is its wide availability and low cost. This has created a small but important market for stover, both as a harvested product and as a standing crop in the field. The following procedure estimates the value of baled stover to the buyer based on the cost of the feedstuffs it replaces for wintering beef cows.

Corn stover can substitute for medium quality mixed hay in a ration for wintering beef cows, if a protein supplement such as dried distillers grains (DDGS) is added. Table 2 shows two recommended rations, with and without corn stover, for 1,200-pound and 1,400-pound beef cows.

Table 2. Estimated feed disappearance for a producing beef cow.

Cow weight	Alfalfa-brome hay + DDGS	Alfalfa-brome hay + cornstalks + DDGS
1,200 pounds	2.4 T. hay + .3 T. DDGS	1.0 T. hay + 1.2 T. stalks + .55 T. DDGS
1,400 pounds	2.6 T. hay + .3 T. DDGS	1.1 T. hay + 1.3 T. stalks + .60 T. DDGS

Assumes 125 days of winter pregnancy and 30 days of lactation before spring calving, and 10% waste.

Source: Managing 2007-08 Cow Herd Feed Needs, Iowa Beef Center, Iowa State University.

Comparing the two rations for each cow weight, each ton of corn stalks added to the ration substitutes for about 1.16 tons of legume-grass hay. Plus, an additional 0.22 tons of DDGS are added. Thus, the value of a ton of stover can be equated to the value of 1.16 tons of mixed hay, minus the value of 0.22 tons of DDGS.

Example 1.

1.16 tons of mixed hay @ \$125	= \$145.00
Minus .22 tons of DDGs @\$260	= <u>\$ 57.20</u>
Value of feed replaced	= \$ 87.80 per wet ton
Minus transport cost (5 mi. @ \$.25/bale)	= <u>\$ 2.08</u>
Feed value at the farm	= \$ 85.72 per wet ton

Cost value

The cost of chopping, raking, and baling corn stover can be estimated from typical farm custom rates, such as are reported in Ag Decision Maker file A3-10, Iowa Farm Custom Rate Survey. Rates used in Example 2 were taken from the 2012 survey. If bales must be transported, that cost should be included, as well. Wrapping the bales with plastic netting instead of twine adds about \$1 per bale to the total cost. Chopping and raking may not be necessary for feed use if the combine leaves residue in a row, or collects it.

Example 2.

Custom stalk chopping	= \$ 11.05 per acre
Custom raking	= \$ 6.20 per acre
Custom baling (\$11.50 / bale x 4 bales/acre)	= \$ 46.00 per acre
Transport (\$.05/mile x 20 mi. x 4 bales/acre)	= <u>\$ 20.00 per acre</u>
Total harvesting cost	= \$ 83.25 per acre

In addition, extra nutrients removed by harvesting must be replaced for future crops. Removal rates have been estimated at 5.9 pounds of phosphate and 25.0 pounds of potash per ton of dry matter stover harvested (ISU Extension and Outreach publication PM-1688). These rates can vary widely depending on the hybrid planted, yields obtained, and how the stover is harvested. A forage laboratory test can be performed to find the specific analysis.

The value of the nutrients being removed can be based on the cost of commercial fertilizer, as shown in Example 3. Replacement costs of \$.53 per pound for P and \$.55 per pound for K are assumed.

Example 3.

Weight of round bale is 1,200 lbs (.6 tons)	
Phosphate removal value = 5.9 lb. @ \$.53	= \$ 3.13 per dry ton
Potash removal value = 25 lb. @ \$.55	= \$ 13.75 per dry ton
Total value of nutrient removal	= \$ 16.88 per dry ton
x 1.92 dry tons harvested per acre	= \$ 32.40 per acre
+ total harvesting cost	= \$ 83.25 per acre
Total cost per acre	= \$115.62 per acre
Divided by 2.4 wet tons per acre	= \$ 48.18 per wet ton

The actual price paid may be negotiated somewhere within this range. In the examples above, the range would be from \$48.18 to \$85.72 per wet ton. If the stover is sold standing in the field, that is, the buyer harvests the stover, the minimum price would only need to cover the costs of added fertility, which in the example is \$16.88 per dry ton or \$13.50 per wet ton at 80% dry matter. Stover values under other assumptions can be analyzed using the Corn Stover Price decision file on the Ag Decision Maker website (see references).

Market Value

Although market prices for harvested corn stover are not reported on a regular basis, bales are sometimes sold at hay auctions. Some auctions report prices on their websites, which can be located by searching on “hay auction.” Recent auction prices in Iowa for large round bales of corn stover ranged from \$25 to \$35 per bale, or \$50 to \$75 per ton, according to USDA hay price reports. These sales would be mostly large round bales suitable for cattle feed or bedding, but not for ethanol production.

References

- Edwards, William. “Estimating a Value for Corn Stover.” 2011. Ag Decision Maker information file A1-70. <http://www.extension.iastate.edu/agdm/crops/pdf/a1-70.pdf> .
- Edwards, William. “Corn Stover Price.” 2011. Ag Decision Maker decision file A1-70. <http://www.extension.iastate.edu/agdm/crops/xls/a1-70cornstoverpricer.xlsx> .
- Jarboe, Darren H., Bobby J. Martens, M. Mainul Hoque, and Georgeanne M. Artz. “Essential Elements for Producer Participation in Biomass Markets.” 2012. Poster presentation, Corn Utilization and Technology Conference, June 4-6. Available online at http://www.ccur.iastate.edu/news/newsletters/2012/may_jun/cutcpresentations/jarboe.pdf